

Management Recommendations for
***Teloschistes flavicans* (Sw.) Norman**

version 2.0

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SUMMARY

Species: *Teloschistes flavicans* (Sw.) Norman

Taxonomic Group: Lichens (Rare Oceanic Influenced)

ROD Components: 1,3

Other Management Status: Oregon Natural Heritage Program: List 2 (taxa that are threatened with extirpation from the State of Oregon); Natural Heritage Networks Rank: Global Rank G4 (not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences); State Rank S1 (critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation in Oregon, typically with 5 or fewer occurrences) (Oregon Natural Heritage Program 1998). BLM Assessment Status (USDI Bureau of Land Management 1998).

Range: In the range of the Northwest Forest Plan, the only substantial population of *T. flavicans* is at Cape Lookout State Park, Oregon. Minor populations occur at New River ACEC (BLM), near Pacific City (BLM), Sand Lake, Cape Blanco State Park and Harris Beach State Park, all in Oregon. *Teloschistes flavicans* is a widespread tropical and subtropical genus in the Western Hemisphere.

Specific Habitat: *Teloschistes flavicans* is confined to forested headlands and dunes of the coastal fog belt, especially on capes or peninsulas. It occurs on exposed branches, twigs and boles of Sitka spruce, shore pine and stems of Hooker's willow in old Sitka spruce/western hemlock or shore pine stands.

Threats: The main threats are activities that directly harm the populations, their habitat, or the potential habitat surrounding populations. Examples of potential threats include: burning (in some places); harvesting trees; constructing roads, trails or buildings; recreational activities; grazing; invasive exotic plants; hydrologic changes; and air pollution.

Management Recommendations:

- Manage known sites to maintain local populations and their habitat area.
- Develop practices to route human use away from known sites.
- Manage fire in habitat areas, with emphasis on prevention.
- Restrict removal of trees, shrubs, moss, or other vegetation from known sites and habitat area, except when removal will not harm habitat integrity.
- Consider opportunities for managing known sites during Forest Plan and Resource Management Plan revisions, such as administratively withdrawn designations, or by prescribing special standards and guidelines.

Information Needs:

- Visit known sites to determine the extent of local populations and improve habitat descriptions.
- Determine if *T. flavicans* is closely associated with late-successional and old-growth forests
- Determine if additional populations exist in areas identified as potential suitable habitat.

Management Recommendations for *Teloschistes flavicans*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Basionym: *Lichen flavicans* Swartz, Nov. Gen. Spec. Plant., 147 (1788)
 Synonyms: *Teloschistes flavicans* Norman, Nyt. Mag. f. Naturvid, 7, 229 (1853)
Physcia flavicans Hook., Hadb. N.Z. Fl., 572 (1867)
Teloschistes chrysophthalmus var. *flavicans* (Swartz) Tuck.
Teloschistes exilis (Michx.) Vainio

Teloschistes flavicans (Swartz) Norman is a lichenized fungus in the family Teloschistaceae, order Lecanorales, class Ascomycetes (Tehler 1996). The photobiont is a species of *Trebouxia*, a green alga (Murray 1960).

B. Species Description

1. Morphology and Chemistry

Teloschistes flavicans is a conspicuous, small to medium sized, fruticose lichen (Figure 1). The thallus is tufted, erect and spreading or, rarely, pendent, and yellow to orange colored. It is occasionally greenish-yellow, or even pale greenish, when grown in the shade (McCune and Geiser 1997). It is composed of many elongated, entangled, somewhat compressed, more or less twisted, pitted or channeled, sorediate branches (Fink 1935). The branches have pointed tips and short pointed side branches, also called cilia (Sanders 1993). The soredia are yellowish in roundish soralia. Apothecia are unknown. The cortex is K+ purple-red, the medulla is K-, KC-, C-, P- (McCune and Geiser 1997).

A similar but smaller non-sorediate species with apothecia, *Teloschistes exilis* (Michx.) Vain., has been collected in the Santa Cruz Mountains and the Channel Islands but is now very rare (Hale and Cole 1988).

2. Reproductive Biology

Asexual reproduction occurs via soredia and thallus fragmentation. Sexual reproductive structures are unknown. The genus as a whole is considered, by some, to be extremely ancient and very slow evolutionary rates have left many species little changed over millions of years (Kärnefelt 1991). In Britain (Gilbert and Purvis 1996), *T. flavicans* can spread locally on an individual tree or boulder but disperses only very slowly to adjacent rocks or tree boles.



Figure 1. Line drawing of *Teloschistes flavicans* by Alexander Mikulin.

3. Ecological Roles

Little is known about the ecological roles of *T. flavicans* in the Pacific Northwest. In general, lichens are able to use not only rain but also fog, dew or atmospheric water vapor as a source of water for positive net photosynthesis. The genus *Teloschistes* is particularly well adapted to low annual rainfall, frequent overcast and fogs with associated high humidity. The ability to reactivate under low thallus moisture content (as low as 15 percent for *Teloschistes capensis*) enables them to grow in areas with low or no rain but with high amounts of atmospheric moisture, most of which is unavailable to vascular plants. Where terricolous (ground-dwelling) species of *Teloschistes* form the predominant component of the perennial plant biomass (Lange *et al.* 1990, Gilbert and Purvis 1996), they are very important in stabilizing soil and protecting it from wind erosion.

C. Range and Known Sites

Teloschistes flavicans is a widespread tropical and subtropical species that occurs sporadically along the west coast of the Americas from Ecuador to northern Oregon (McCune and Geiser 1997). Although Fink (1935) reported *T. flavicans* along the eastern seaboard from Massachusetts to Florida, and from Texas, Oregon and Nevada, he considered *T. flavicans* and *T. exilis* to be conspecific. Hale's (1979) maps show the latter species only from southern California and southern Texas, Louisiana and Mississippi. However, a current search and re-examination of collections at Duke University and the US National Museum at the Smithsonian Institute conducted by Dr. Irwin Brodo of the Canadian National Museum (pers. comm. 1997), revealed that *T. flavicans* does indeed occur on the eastern seaboard in Georgia, North Carolina, Massachusetts, and Nova Scotia. Although *T. flavicans* occurs sporadically in coastal California in Sonoma, Marin, Monterey, San Diego, San Mateo, Santa Barbara, and San Luis Obispo counties, none of these sites are within the range of the Northwest Forest Plan.

In the area covered by the Northwest Forest Plan, *T. flavicans* is currently known only from Oregon. The only substantial population of *T. flavicans* is at Cape Lookout State Park (Tillamook County) in northern coastal Oregon (McCune and Geiser 1997). Two sites with minor populations are known on federal land: New River Area of Critical Environmental Concern (ACEC) in Curry County on the BLM Coos Bay District, and a BLM Salem District parcel just north of Pacific City (Tillamook County). The remaining known populations are small and are not on federal land: Sand Lake vicinity 10 km (6 mi) south of Cape Lookout (Tillamook County); Cape Blanco State Park and Harris Beach State Park (Curry County).

D. Habitat Characteristics and Species Abundance

Teloschistes flavicans is rare throughout the range of the Northwest Forest Plan, and reaches the apparent northern limits of its range in Oregon. Within this area, it appears to be confined to exposed headlands and dunes of the immediate coast in Oregon. All known sites are under 200 m (660 ft) elevation. At Cape Lookout, where the largest known population is located, *T. flavicans* is found on the twigs of Sitka spruce (*Picea sitchensis*) and is common in the litterfall of an old Sitka spruce forest on the long, forested headland of the peninsula. At Cape Blanco, *T. flavicans* grows on the boles and limbs of exposed Sitka spruce and Hooker's willow (*Salix hookeriana*) in an open Sitka spruce forest. At New River ACEC, where it is rare, it is found on

shore pine (*Pinus contorta*) in a mature shorepine forest at the edge of a pasture. At Sand Lake it occurs on Sitka spruce. Just 1 km (0.6 mi) northwest of Pacific City, it occurs in the twig litterfall of a small, old, mixed shore pine and Sitka spruce forest on a knoll east of the dune. In southern California, *T. flavicans* grows on conifers and other trees (e.g. *Quercus*) in coastal scrub stands. One collection from San Mateo County is on sandstone.

In Great Britain, *T. flavicans* displays a habitat range that encompasses epiphytic, saxicolous (rock-dwelling) and terricolous communities. All the terricolous and saxicolous sites are coastal; inland it occurs only as an epiphyte. Host plants include ash (*Fraxinus*), maple (*Acer*), oak (*Quercus*), cherry (*Prunus*), alder (*Alnus*), and rhododendron (*Rhododendron*). The typical host tree is large, free-standing and with a well-illuminated trunk exposed to the wind, typically at a height of 1-4 m (3-12 ft) on the trunk, but, if the canopy is open, it may extend high into the upper branches. The largest colonies are on coastal granite, and encompass many thousands of plants. Around 1 percent of the British population is terricolous, growing up to 15 cm (6 in) deep between wind-clipped heaths or on soil with *Armeria* (sea-pink), fescue (*Festuca*), plantain (*Plantago*) and stonecrop (*Sedum*). In windswept locations where the higher plant cover is very open, it can be attached to other lichens, the soil or to fescue culms (Gilbert and Purvis 1996).

II. CURRENT SPECIES SITUATION

A. Why Species is Listed Under Survey and Manage Standard and Guideline

Teloschistes flavicans was considered at risk under the Northwest Forest Plan because of its rarity and limited distribution within the range of the northern spotted owl (USDA and USDI 1994a, 1994b). At the time of the viability panel, *T. flavicans* was only known from two populations in the range of the northern spotted owl (USDA and USDI 1994a, 1994b). Ratings by the lichen viability panel reflected a high level of concern for this species. The rare oceanic influenced lichens as a group received the lowest viability ratings among all the lichens considered (USDA and USDI 1994a).

Because of the low viability ratings and high level of concern, this species was identified as a Survey and Manage strategy 1 and 3 species, with the dual objectives of managing known sites, and conducting extensive surveys to locate additional populations and identify other high-priority sites for species management (USDA and USDI 1994c).

B. Major Habitat and Viability Considerations

Frequent fog along the coast, combined with moderate temperatures, create suitable habitat for oceanic-influenced lichens such as *T. flavicans*. The broken topography, natural firebreaks and ocean spray all act to reduce the influence of fire on the immediate coast, thus favoring higher species diversity and successful colonization by rare species such as *T. flavicans* (McCune *et al.* 1997).

The major concerns for this lichen are the small number of populations, the limited amount of suitable habitat for this species on federal land, and loss of populations from management activities that directly impact the remaining habitat or populations. Much of the low elevation coastal forest land in the Pacific Northwest is under nonfederal ownership. This land includes thousands of acres that are generally managed on short harvest rotations. Given that lichens are slow to establish in rapidly growing stands (USDA and USDI 1994a) and do not become abundant until later in successional development, most of these stands are harvested before lichens have a chance to re-establish significant populations.

Isolation of populations also leads to genetic isolation. Almost nothing is known about the genetics of lichen populations or the effects of gene pool isolation on local extinction rates of populations.

C. Threats to the Species

Threats to *T. flavicans* are those actions that disrupt stand conditions necessary for its survival. Such actions include treatments that reduce local populations by removing colonized bark or wood substrates; decreasing exposure to light; adversely affecting integrity of habitat areas; reducing or fragmenting potential habitat; or degrading air quality.

Recreational activities and developments may inadvertently alter the habitat of this species. Trampling by recreational vehicles and frequent foot traffic are serious threats, especially in shore pine woodlands and edge communities, as these degrade the habitat by disturbing fragile root systems of trees and shrubs, and the fragile protective mats of ground cryptogams, which stabilize the soil (Christy *et al.* 1998). Destabilization of the foredunes by recreationists or removal of European beachgrass (*Ammophila arenaria*) can destabilize tree island habitats of *T. flavicans* by increasing the amount of sand drift into them and burying trees on the perimeter (Christy *et al.* 1998). Buildings, roads, campgrounds and trails along the immediate coast have replaced many natural habitats to improve access, facilitate scenic views, or develop recreational uses.

Other threats to the integrity of habitat and potential habitat areas include logging, grazing, agriculture, and activities which alter local hydrology, or increase fire frequency (Christy *et al.* 1998). Concern about fire varies--many different plant communities and successional stages exist among the coastal dunes and headlands; fire is beneficial to some communities but damaging to others. Invasion or planting of exotics such as Scots broom (*Cytisus scoparium*), European beachgrass, tree lupine (*Lupinus arboreus*), birdsfoot-trefoil (*Lotus corniculatus*), and iceplant (*Mesembryanthemum* spp.) can have profound effects on nitrogen-poor dune soils by increasing nitrogen and soil moisture. These conditions foster invasion of other weeds, eventually disrupting native plant communities (Christy *et al.* 1998) and reducing plant and animal diversity (USDI 1997).

Teloschistes flavicans is considered highly sensitive to air pollution; it cannot tolerate sulfur dioxide concentrations of 20 ppm (Gilbert and Purvis 1996). Because the primary habitat of this lichen is the coastal fog belt, and because fog significantly concentrates pollutants, especially acidic forms of SO_x and NO_x to which lichens are most sensitive, the potential vulnerability of *T. flavicans* to air-quality deterioration is a reasonable concern. Air quality is relatively good at

known sites, but emissions from increased traffic (mainly NO_x) or new point sources (SO_x and NO_x), could threaten this species in the future.

Climate change affecting coastal fog patterns could be expected to affect the vigor of this species, possibly resulting in an even more restricted distribution or contributing to local extirpation.

D. Distribution Relative to Land Allocations

The key population of *T. flavicans* in the area of the Northwest Forest Plan is at Cape Lookout State Park, Oregon. *Teloschistes flavicans* occurs at two sites on federal land, but both support only small populations. The New River Area ACEC on the Coos Bay District BLM is administratively withdrawn. The land allocation for the Salem District BLM parcel just north of Pacific City is unknown at this time

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *T. flavicans* is to assist in maintaining species viability.

B. Objectives

Manage populations at all known sites on federal lands by maintaining habitat and potential habitat immediately surrounding known populations.

IV. HABITAT MANAGEMENT

A. Lessons From History

The majority of species in the genus *Teloschistes* are known only from scattered localities in isolated regions (Kärnefelt 1991). Scattered populations may cushion a species against world-wide extinction, but individual populations can be very vulnerable. Giess (1989) documented a dramatic decline in one such isolated population of *Teloschistes capensis* in Namibia that resulted from mechanical damage by off-road vehicles. A population of *T. flavicans* in Britain was lost to rabbit grazing (Gilbert and Purvis 1996). In southern California, *T. flavicans* is now quite rare because of urbanization and loss of habitat (Hale and Cole 1988).

One of the best documented declines of *T. flavicans* was described recently by Gilbert and Purvis (1996). Using accurate historical records, they were able to document the loss of most inland populations of *T. flavicans* in central England and Wales since 1960. The authors believe the gradual contraction of *T. flavicans* is largely from the spread of air pollution in central and southern England. Although some large saxicolous and terricolous populations remain on the coast, the remaining epiphytic colonies are threatened, even within the clean air area of southwest England. This is because most populations are on single, large mature trees and

appear unable to spread onto adjacent trees or bushes. Thus the lifespan of the population is limited by that of its host. Eight sites are known to have been lost from tree mortality or destruction over the last 25 years. General land use changes have also been detrimental, particularly the clearing of old orchards and wayside trees and the death of elms; all were once major habitats.

Lichens have been known to be sensitive to air pollution for over a century. Many species in Europe are in an active state of decline from sulfur dioxide, nitrogen oxides and acidic deposition of sulfur and nitrogen containing pollutants (Ferry *et al.* 1973, Hawksworth and Rose 1976). Fog contains higher levels of dissolved ions and acidity than precipitation, rain or snow (Wolseley and James 1992). Lichens that obtain most of their water from fog and dew, are particularly vulnerable to air quality and weather pattern changes (Nash 1996). Follmann (1995) documented massive impoverishment and retrogression of lichens over much of the northern Chilean coastal fog belt during the past twenty years. Increasing frequency of El Niño events and gradually increasing aridity were postulated as likely, but not exclusive, causal factors in this decline. *Teloschistes flavicans* is a highly sensitive member of the coastal fog belt community of the Americas.

B. Identifying Habitat Areas for Management

All known sites of *Teloschistes flavicans* on federal land administered by the Forest Service and BLM in the range of the Northwest Forest Plan are identified as habitat areas where these management recommendations should be implemented. A habitat area for management is defined as suitable habitat occupied by or near a known population.

C. Managing in Habitat Areas

The objective of management within habitat areas is to maintain habitat conditions for *T. flavicans*. Specific habitat conditions known for *T. flavicans* are the foggy coastal headlands and dunes with old Sitka spruce, western hemlock, shore pine, or Hooker's willow.

- Determine the extent of the local population and habitat area with a site visit.
- Maintain suitable habitat around the current host trees and shrubs, so that the lichen may have adequate new substrate as current substrates decline.
- Develop practices to route human use away from the populations in habitat areas (for example, divert roads, trails and off-road vehicles). Trampling shrubs or ground vegetation, compacting roots, damaging trees or branches that serve as substrates, introducing non-native species by seed dispersal or planting, can all adversely affect habitat integrity.
- Avoid harvesting trees, shrubs, or other vegetation from the population and the habitat area unless these actions would do no harm to, or would improve, the habitat for *T. flavicans* (for example, by preventing deeply shaded conditions or by removing invasive exotics).
- Prevent fire in the population but utilize or prevent fire in the habitat areas, depending on the role of fire in the plant community. Consider recommendations by Christy *et al.* (1998) for fire management in coastal plant communities.
- Restrict commercial collection of moss or fungi or other special forest products if these activities would adversely affect the integrity of habitat areas.

D. Other Management Issues and Considerations

- No key populations exist on federal land. Discovery of large populations on federal land or successful transplantation of this lichen to suitable habitat on federal land would reduce persistence concerns.
- Consider opportunities for managing known sites during Forest Plan and Resource Management Plan revisions, such as Botanical Special Interest Areas, Areas of Critical Environmental Concern, or other administratively withdrawn designations, or by prescribing special standards and guidelines.
- Share information with state and private sectors to further activities directed at conserving *T. flavicans*.
- Continue to work with state and federal regulatory agencies to protect air quality on federally-managed lands from on- or off-site emissions, especially of nitrogen- and sulfur-containing pollutants.
- Provide information about conserving rare lichens at visitor centers or other locations along the coast to build public support of conservation efforts and to discourage collection of specimens.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities to acquire additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

- Visit known sites to determine the extent of local populations and improve habitat descriptions.
- Determine if *T. flavicans* meets the criteria for being closely associated with late-successional and old-growth forests.
- Determine whether additional populations exist in areas identified as potential suitable habitat. Potential suitable habitat is foggy coastal windswept headlands and dunes with scattered old Sitka spruce, shore pine, western hemlock, especially on capes and jutting peninsulas.
- Prioritize Strategy 3 surveys in areas where management treatments or projects are scheduled or proposed in potential suitable habitat.

B. Research Questions

- What are the dispersal rates and mechanisms of *T. flavicans*?
- Which habitat characteristics are necessary for establishment and survival of *T. flavicans* propagules and colonies?
- What are the minimum and optimum patch sizes of colonized habitat necessary to provide for *T. flavicans*?

- Can transplants be used to create new populations for *T. flavicans* to increase its population base on federal land?
- What is the genetic diversity of *T. flavicans* in local populations and across the region?

C. Monitoring Needs and Recommendations

- Monitor dispersal and population trends of existing populations.
- Monitor known sites for changes in microclimatic conditions, successional changes, and for inadvertent habitat damage from human activities or wildfire.
- Monitor air-quality effects on *T. flavicans*. Evaluate point sources and regional or local urban emissions along the coast within the range of the Northwest Forest Plan. Monitor populations at highest risk.

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